APEC Energy Demand and Supply Outlook 8th Edition: Japan Key Findings

IEEJ Global Energy Webinar
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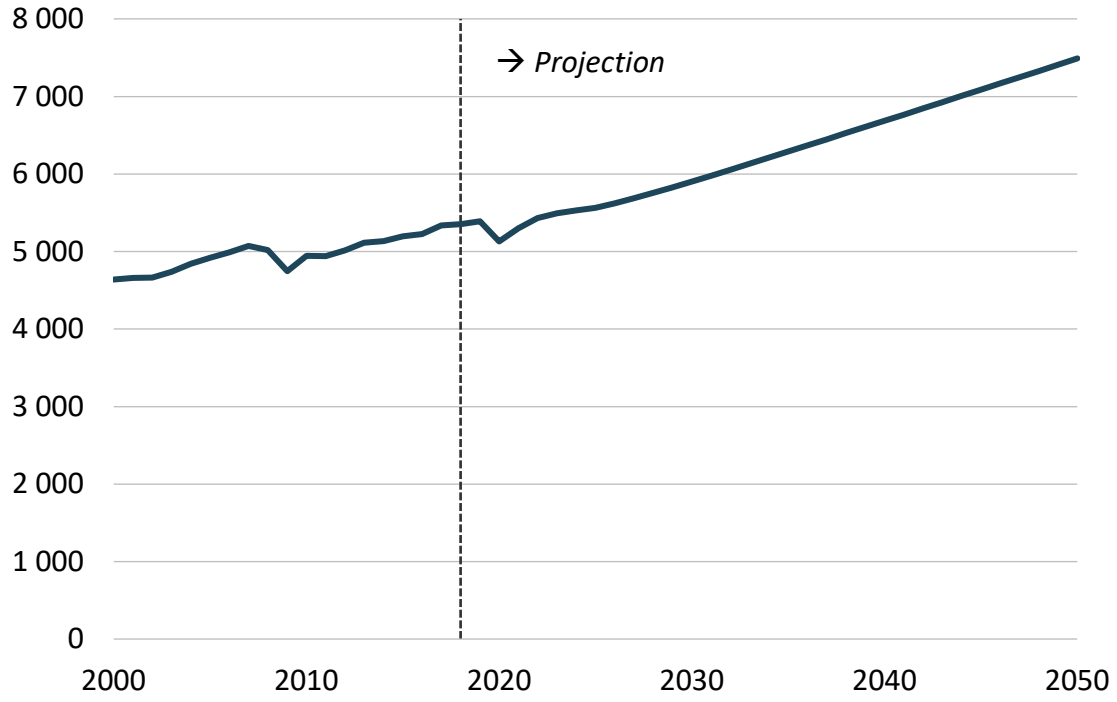
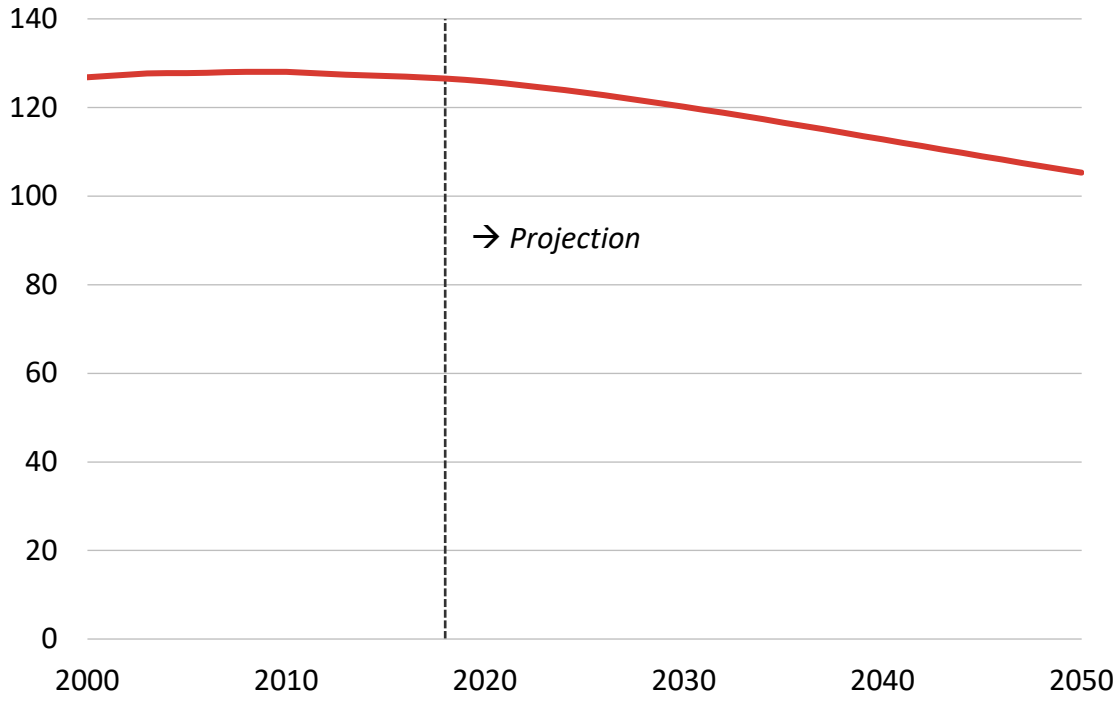
Macroeconomic backdrop

GDP in billion 2018 USD PPP, 2000-2050



Notes: Historical GDP data from World Bank WDI. GDP projections from OECD and internal analysis. COVID-19 impact on GDP is incorporated in the 2020-2025 timeframe based on IMF projections (May 2021).

Population in millions, 2000-2050

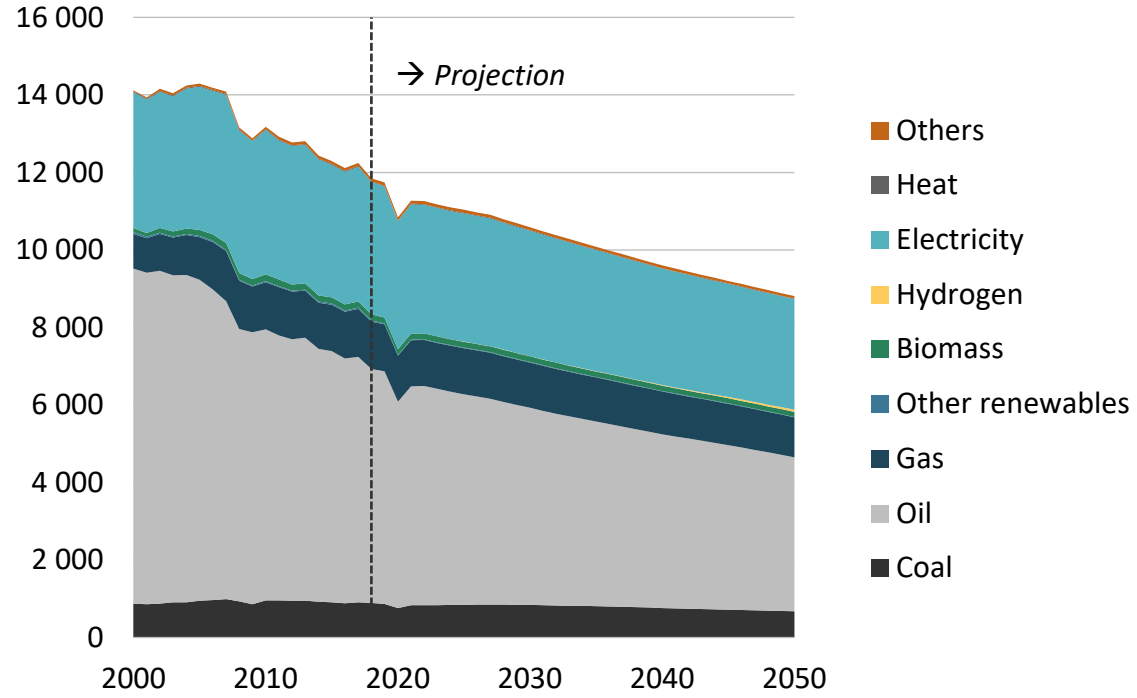


Notes: Historical population data from World Bank WDI. Projections from UN Department of Economic and Social Affairs 2019 Population Prospectus.

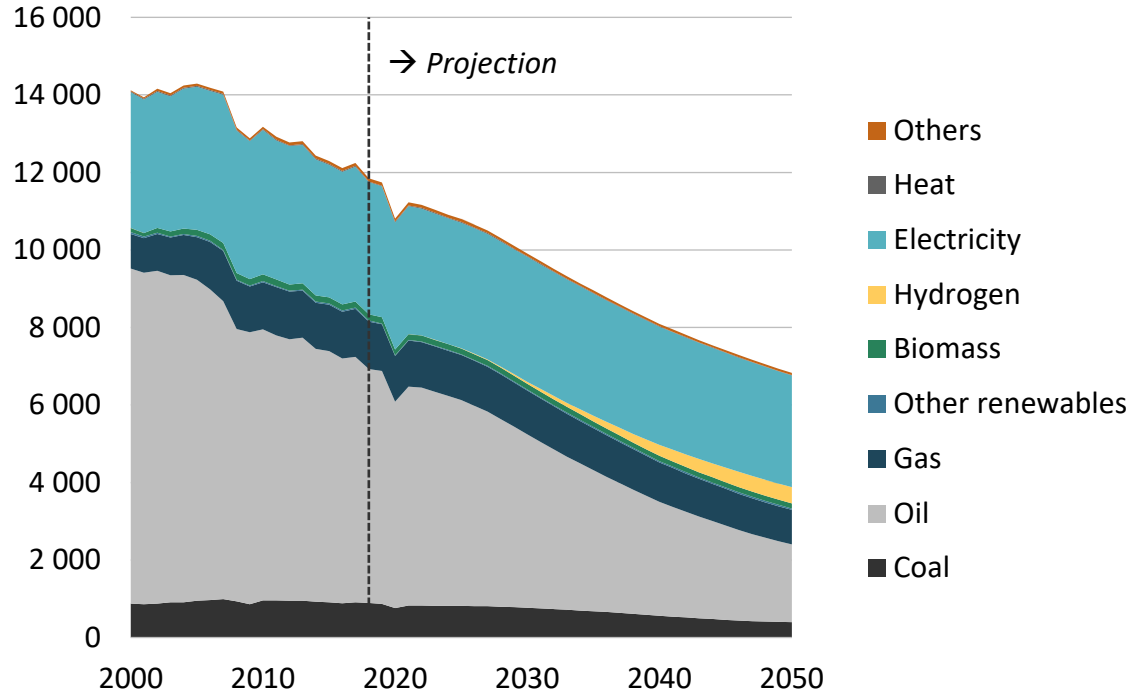
- Japan's GDP growth is assumed to be moderate through the projection period (1.1% average annual growth in constant USD).
- Japan's population peaked in the 2000s and is projected to continue to decline.

End-use energy demand by fuel

Energy demand in REF, 2000-2050 (PJ)



Energy demand in CN, 2000-2050 (PJ)

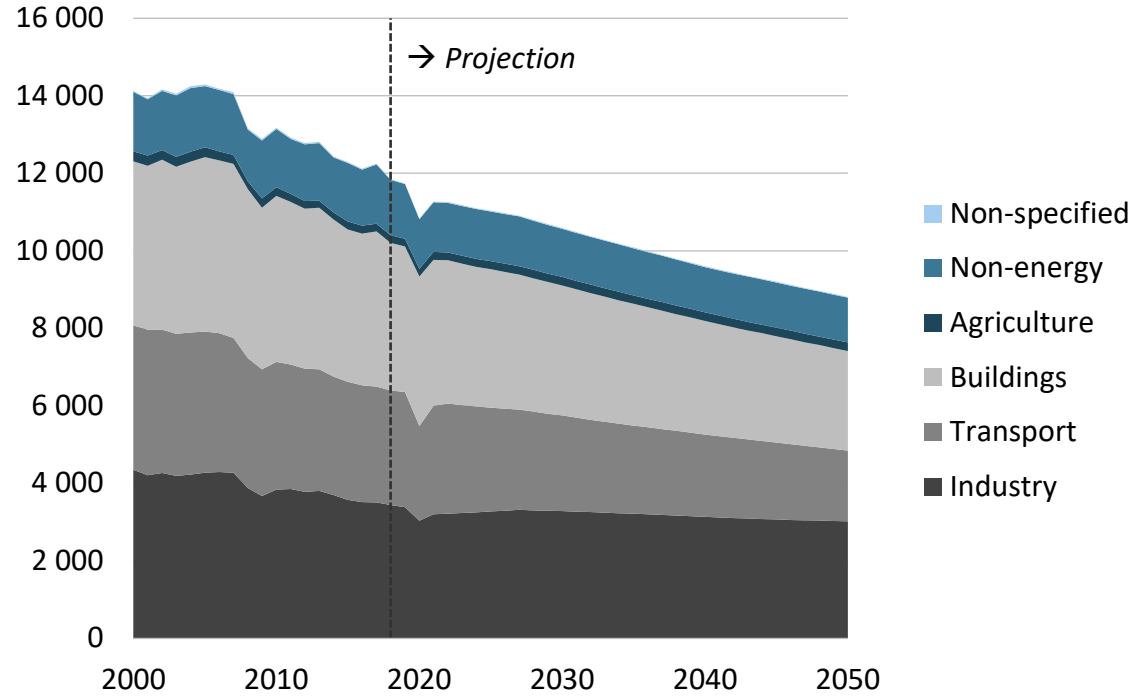


Sources: EGEDA, APERC analysis. Includes non-energy.

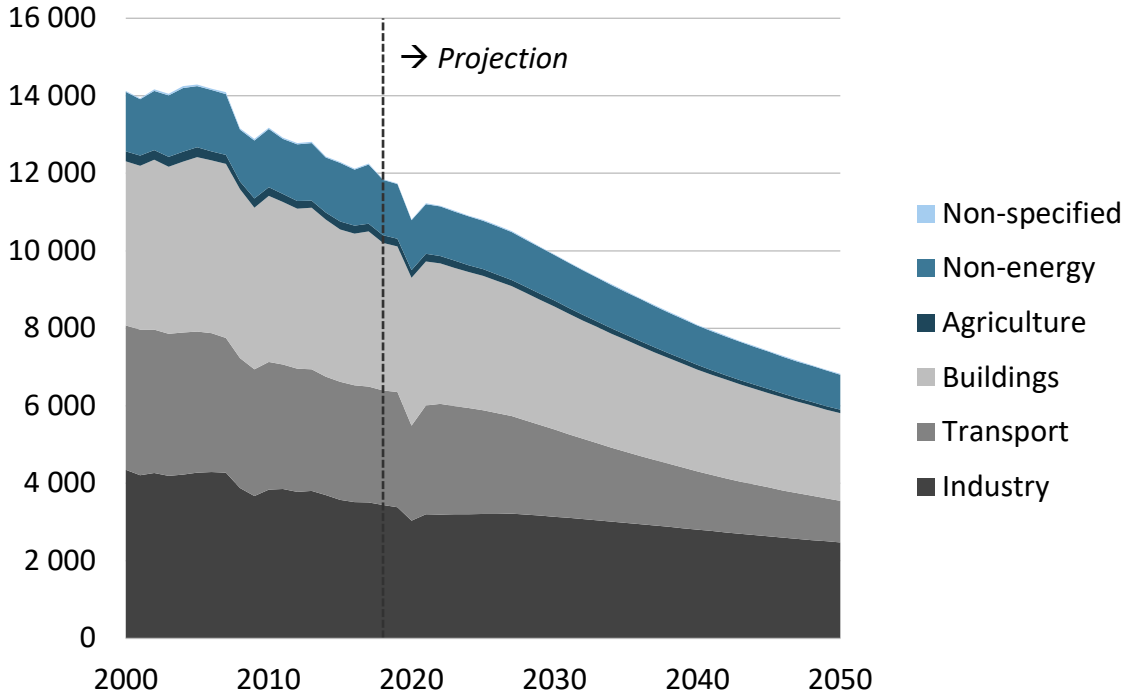
- Energy efficiency and demographics support continued decline in end-use energy demand.
- Electricity, gas, and hydrogen all have higher relative shares in CN, mostly displacing oil.

End-use energy demand by sector

Energy demand in REF, 2000-2050 (PJ)



Energy demand in CN, 2000-2050 (PJ)

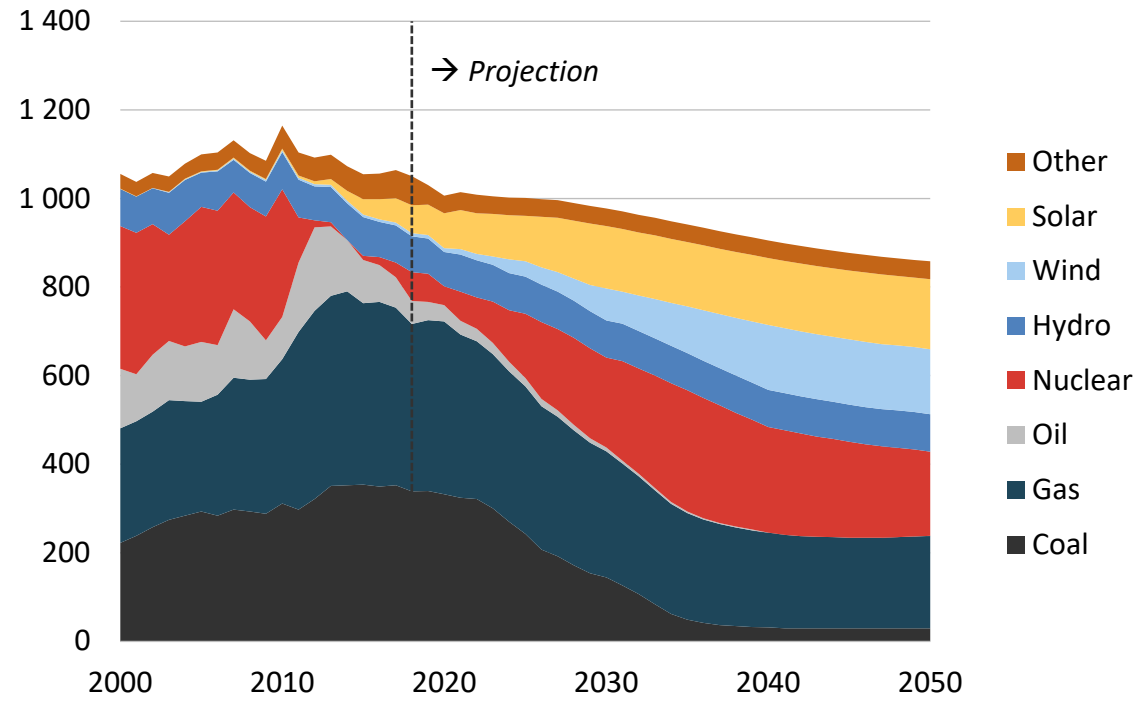


Sources: EGEDA, APERC analysis. Includes non-energy.

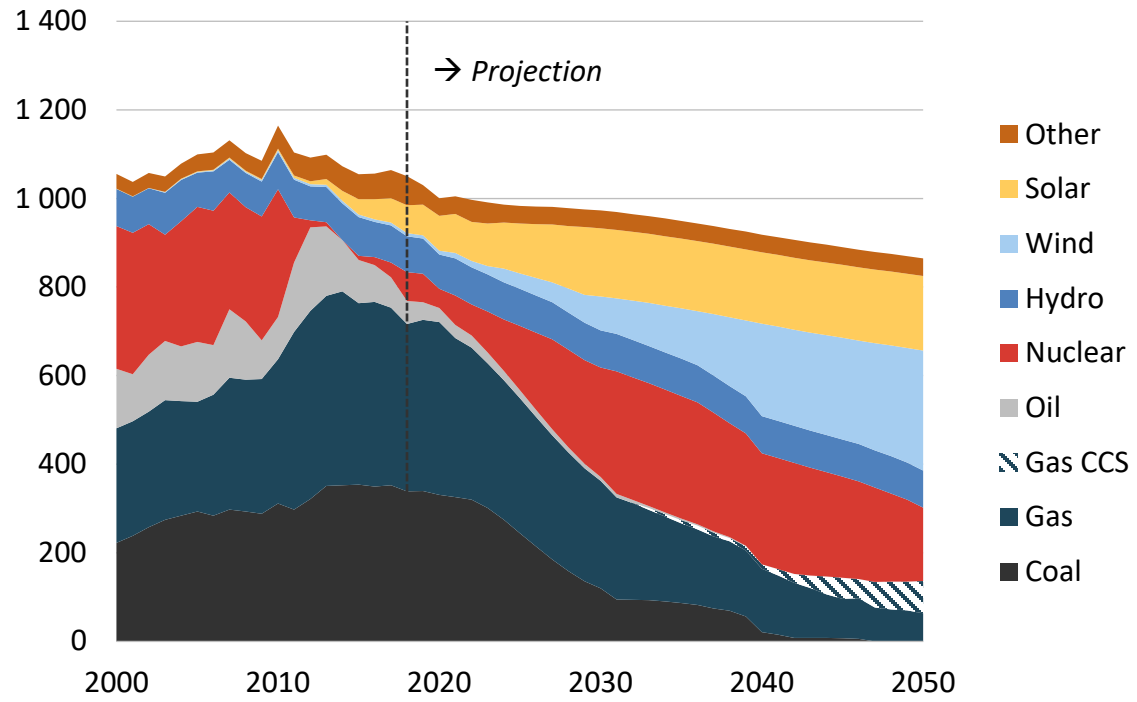
- The industrial sector declines by less than other sectors, due to three factors:
  - Current high levels of efficiency.
  - Output being tied closer to trade rather than domestic consumption.
  - Difficulty electrifying some of the largest energy consuming segments in the industry sector.

Electricity generation by source

Electricity generation in REF, 2000-2050 (TWh)



Electricity generation in CN, 2000-2050 (TWh)

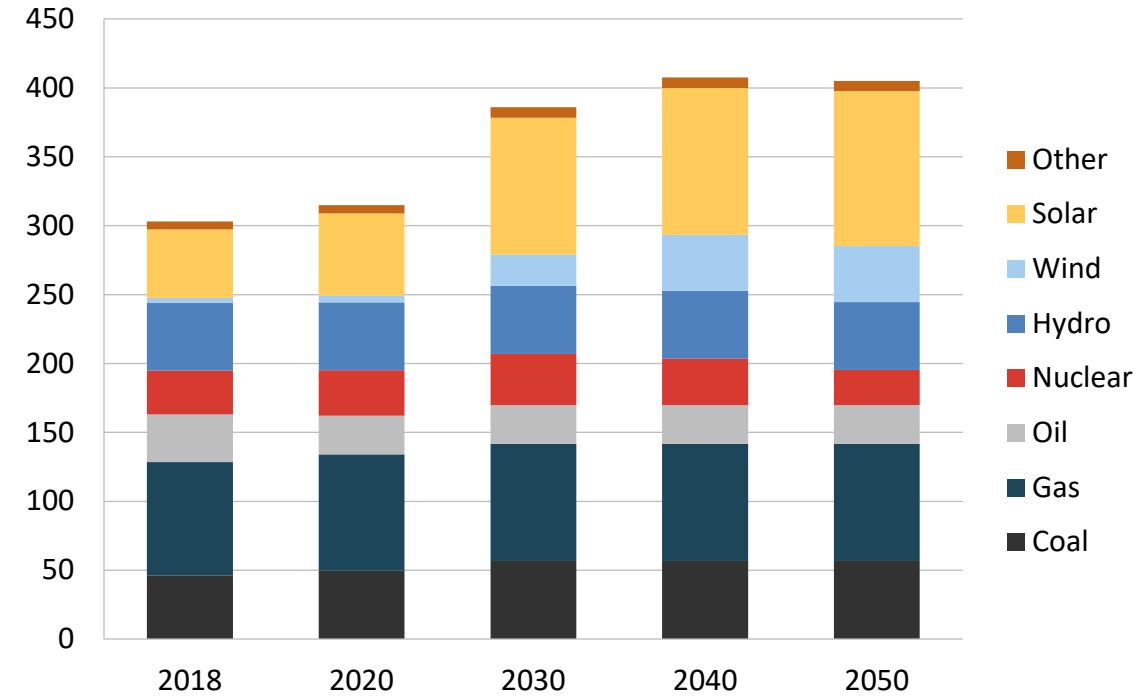


Sources: EGEDA, APERC analysis.

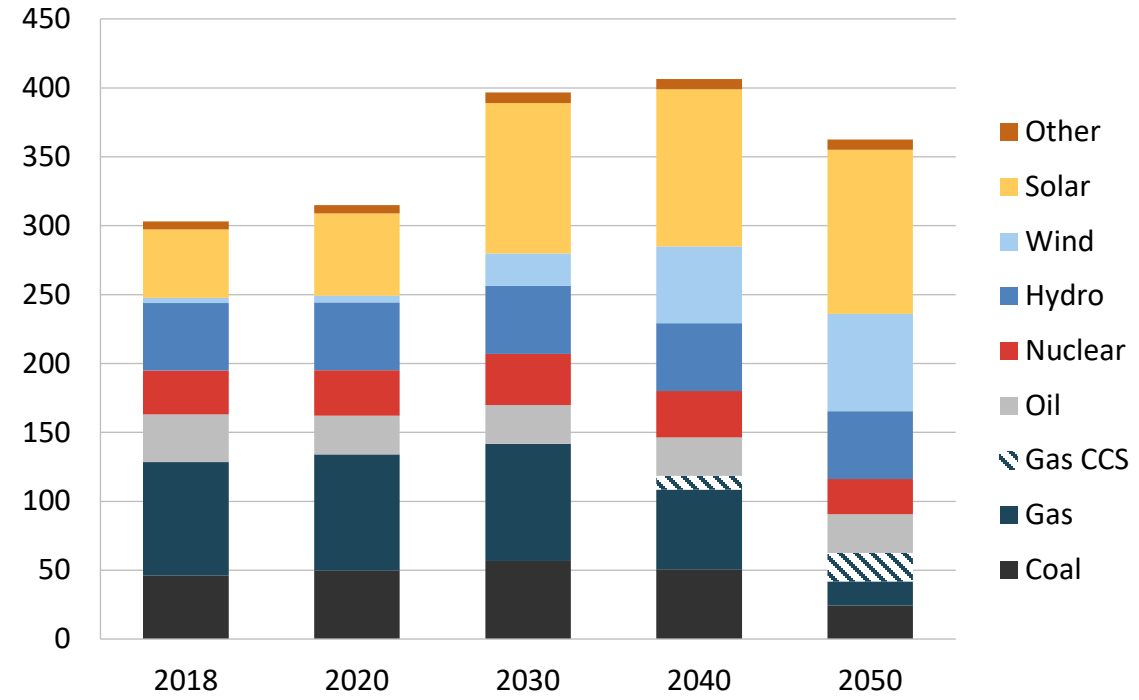
- Greater electrification of end-uses is offset by declining need for energy in CN.
  →REF and CN electricity consumption is similar.
- Wind becomes more prominent in CN, mostly displacing gas.
- Both scenarios align with recent announcements about reopening nuclear plants (no new builds).

Generation capacity

Capacity in REF, 2018-2050 (GW)



Capacity in CN, 2018-2050 (GW)

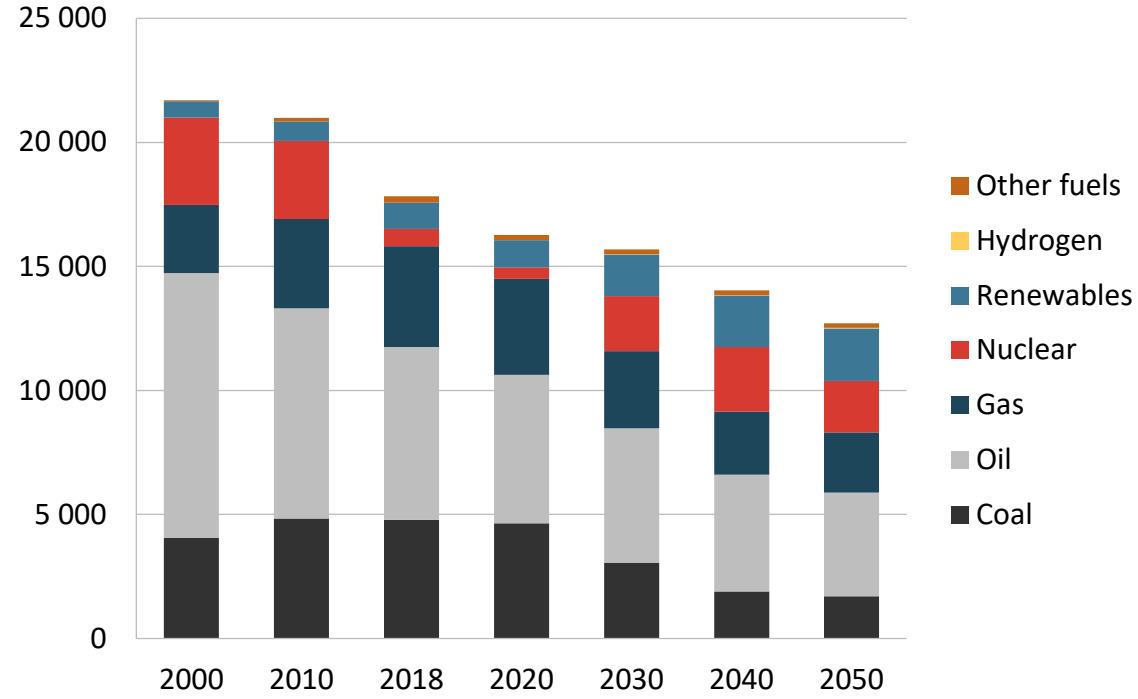


Sources: EGEDA, APERC analysis

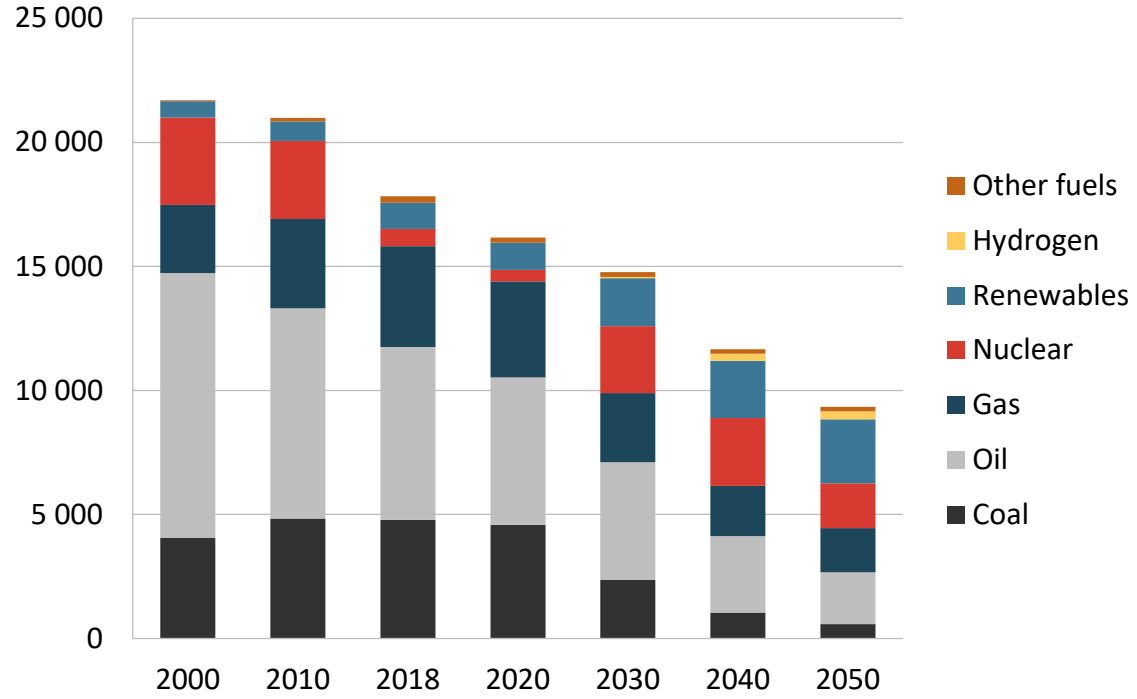
- In REF, generation capacity increases by a third to over 400 GW in 2050.
- In CN, the fall in capacity is mostly due to the closure of coal and gas power plants.
- CCS plays an important role for reducing unabated natural gas plants.

Energy supply

Total energy supply in REF, 2000-2050 (PJ)



Total energy supply in CN, 2000-2050 (PJ)

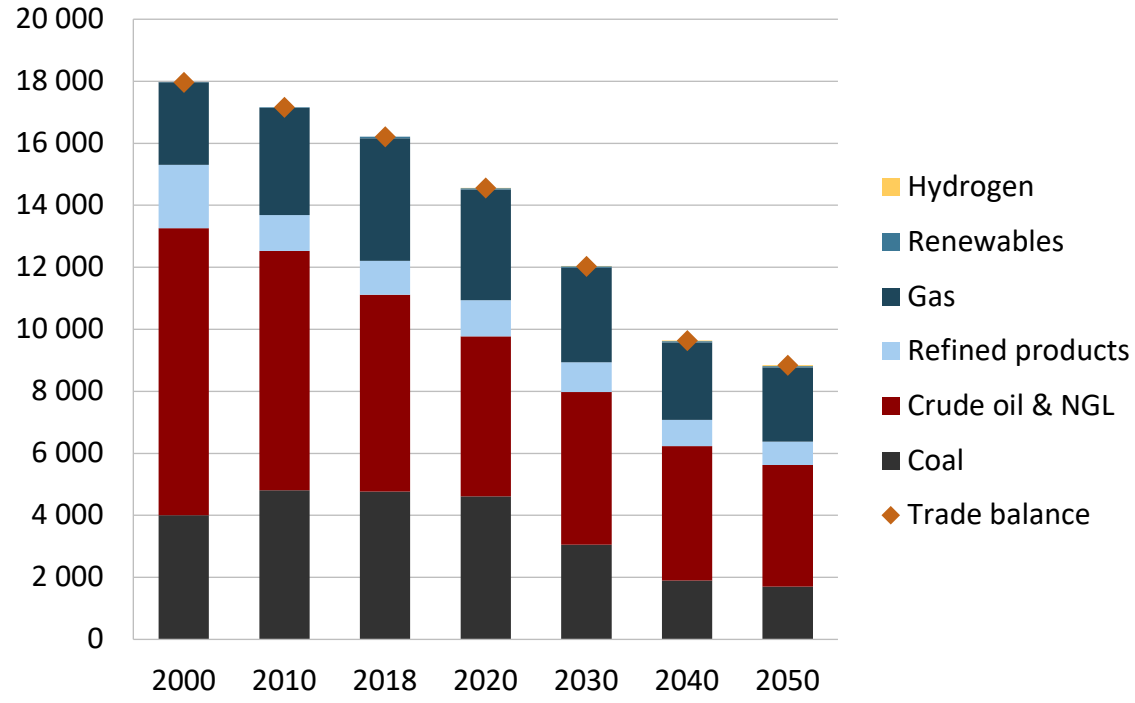


Sources: EGEDA, APERC analysis.

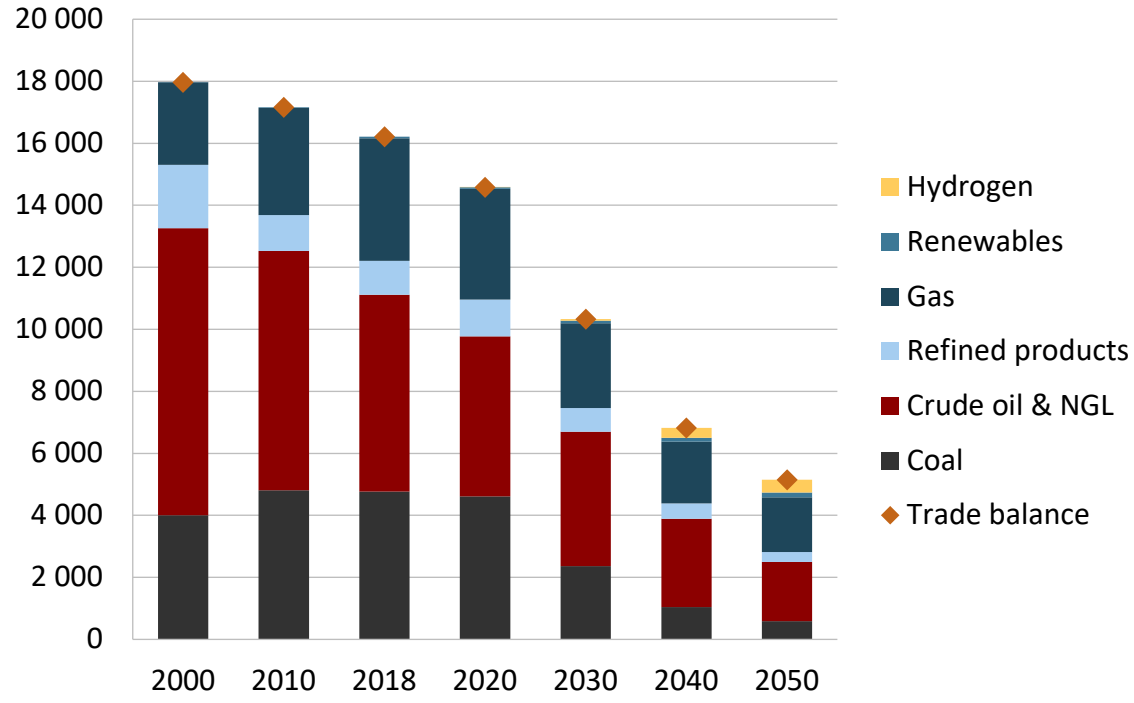
- Fossil fuels are two-thirds of energy supply in REF, but less than half in CN.
- In CN, industry consumption of coal is displaced by alternative fuels such as gas, hydrogen and electricity.

Net energy trade

Net energy trade in REF, 2000-2050 (PJ)



Net energy trade in CN, 2000-2050 (PJ)

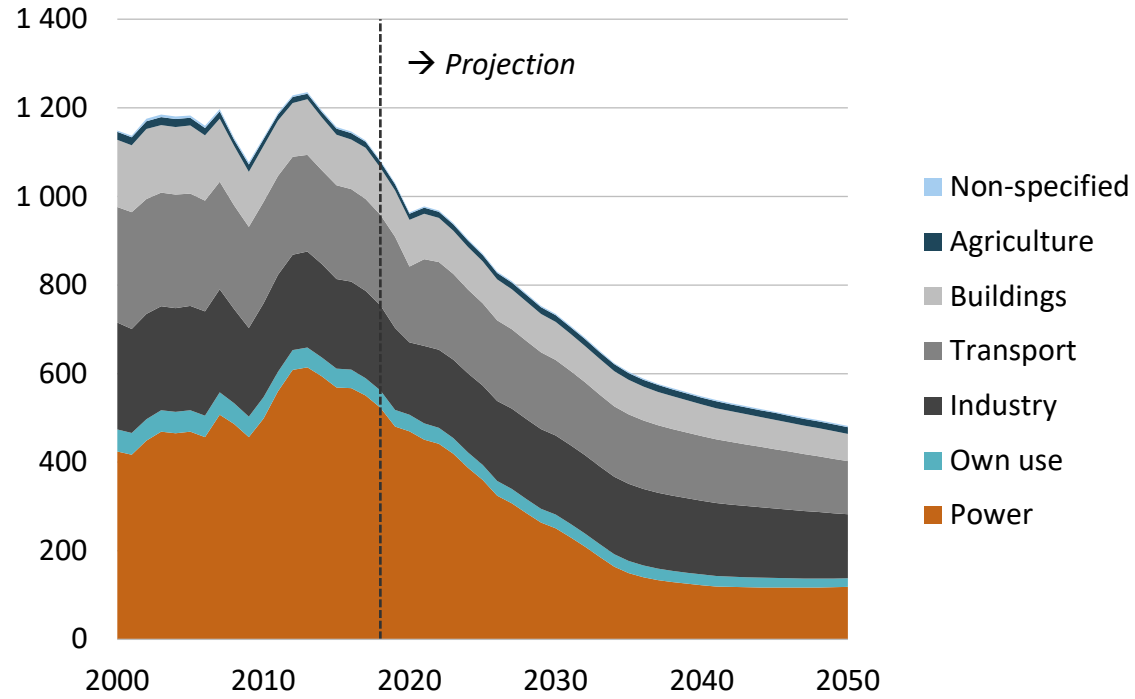


Sources: EGEDA, APERC analysis. Exports appear as negative.

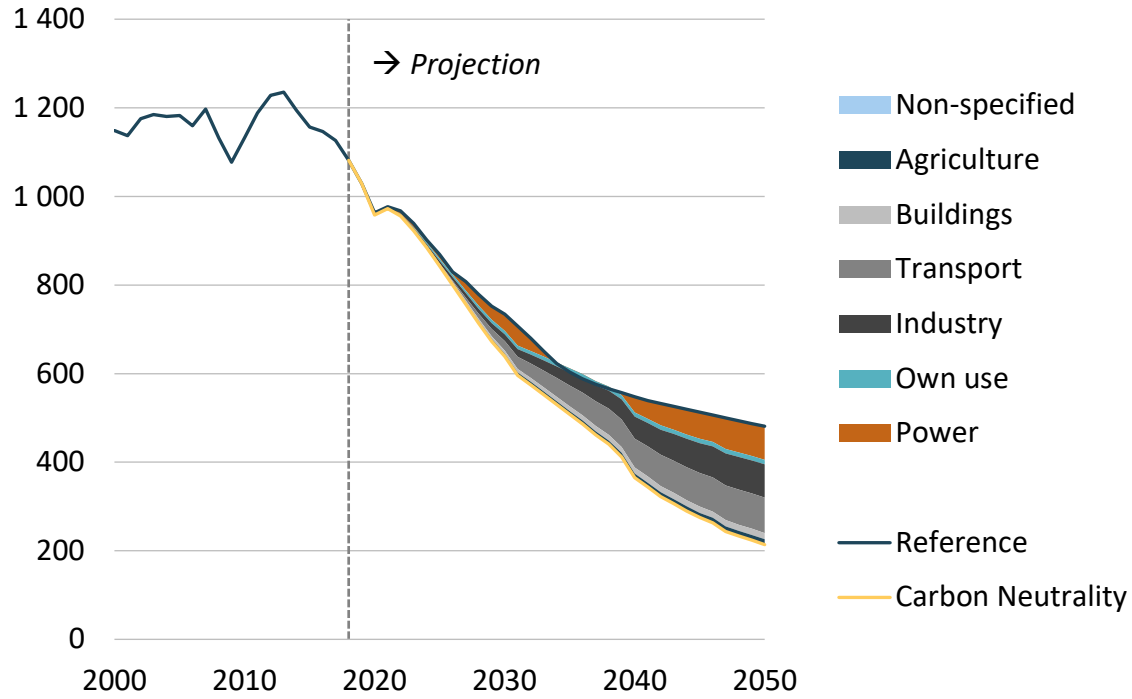
- Japan remains reliant on energy imports from the rest of the world.
- That reliance is falling and is much lower in CN (5,000 PJ versus 9,000 PJ).
- Hydrogen is only a small component of total energy supply, even in CN.

CO_2 emissions

Gross CO_2 emissions in REF, 2000-2050 (million tonnes)



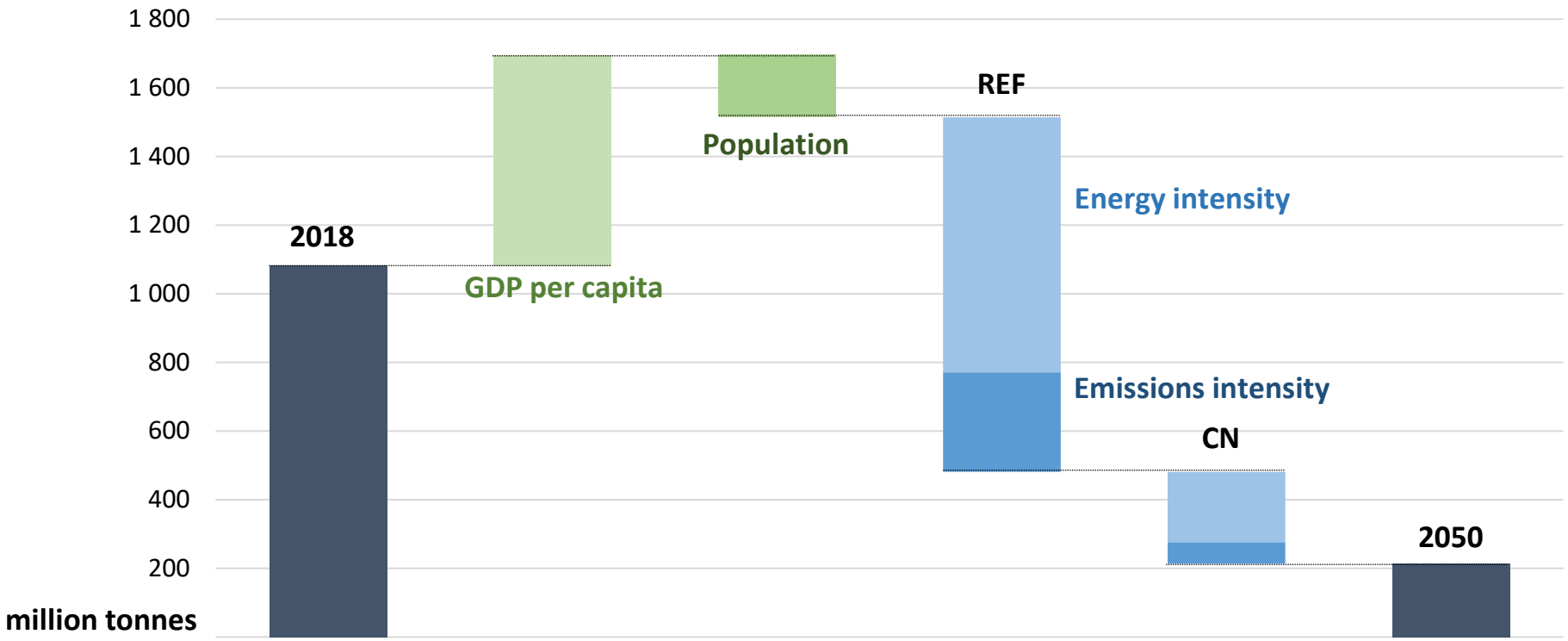
Change in gross CO_2 emissions, 2000-2050 (million tonnes)



Sources: UNFCCC, EGEDA, APERC analysis. Excludes non-energy, land-use, and methane emissions.

- From 2013 to 2030, CO_2 emissions are projected to decline by 41% in REF, and by 48% in CN.
- Transport emissions decline by 80% which is the largest sectoral reduction relative to REF.

Breakdown of energy-related CO_2 emissions

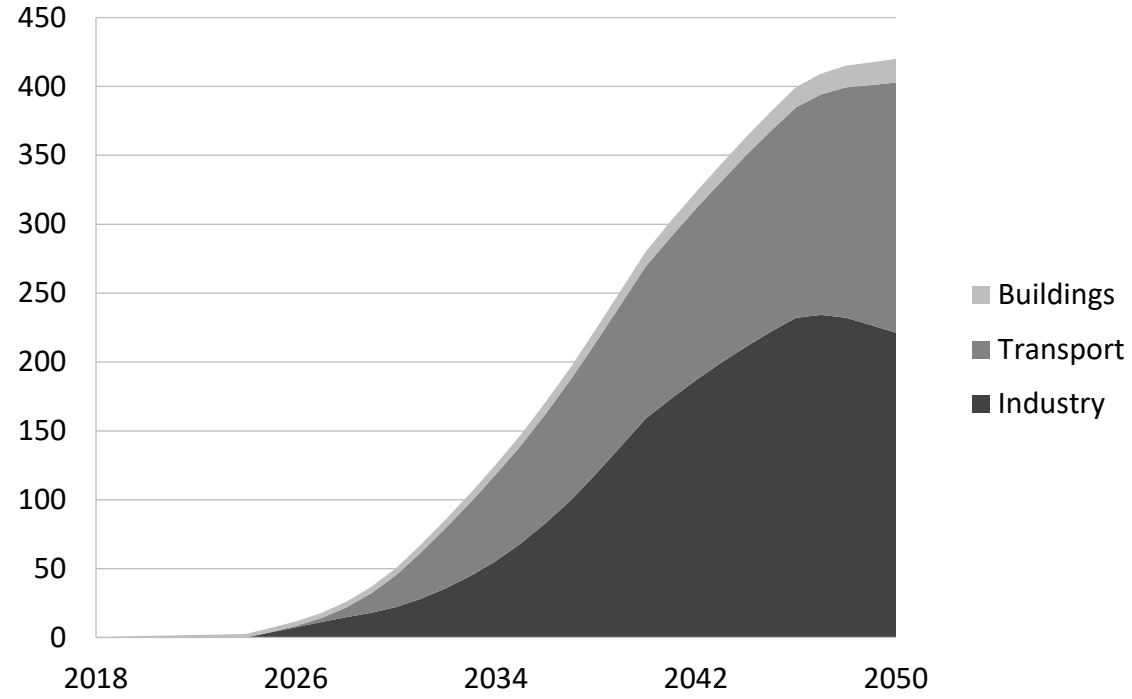


Sources: UNFCCC, EGEDA, APERC analysis.

- Population decline lowers CO_2 emissions.
- Economic activity increases emissions by 40%.
- Energy intensity is a larger driver of emission reductions in both scenarios.

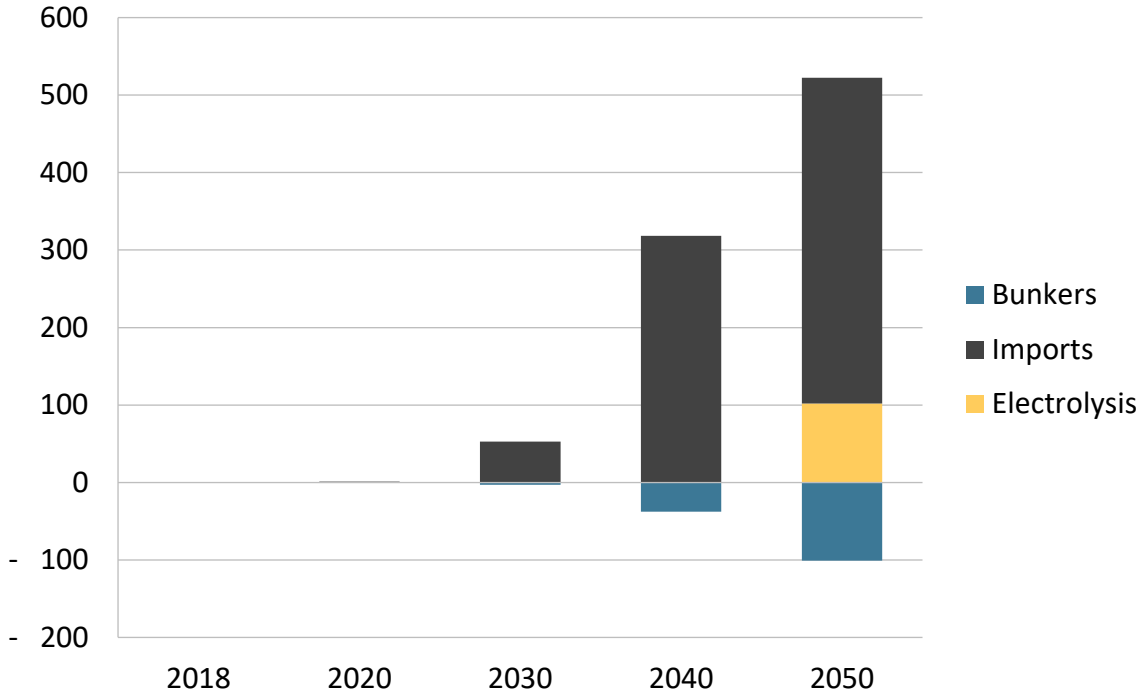
Uncertain Futures: Hydrogen in CN

Hydrogen consumption by sector in CN, 2000-2050 (PJ)



Notes: hydrogen as an industrial feedstock is not considered.

Hydrogen production, imports, and exports in CN, 2000-2050 (PJ)

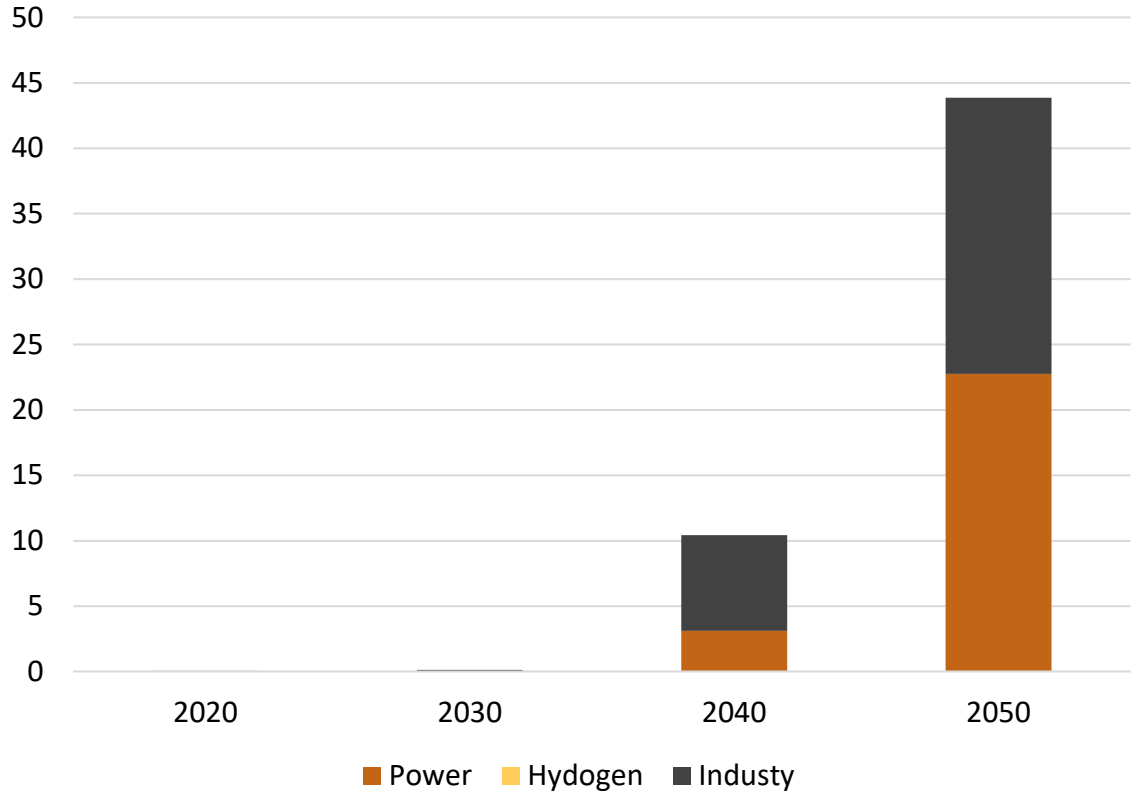


Notes: hydrogen as an industrial feedstock is not considered. Exports are produced from steam methane reformation with CCS (blue) or electrolyser processes (green).

- CN relies on cost assumptions well below current levels.
- Industry shows largest potential for hydrogen applications.
- Japan will be reliant on hydrogen imports, though electrolysis could meet some of its demand.

Uncertain Futures: CCS

Captured CO_2 emissions in CN (million tonnes)



Sources: EGEDA, APERC analysis

- CN assumes CCS costs well below current levels.
- Industry and power sector are assumed to adopt CCS technologies from the 2030s in Japan.
- Almost 45 million tonnes of captured emissions in 2050 is significant in the context of 200 million total tonnes of CO_2 emissions in Japan in 2050 in CN.

Summary of key findings for Japan

- Japan is one a few APEC economies experience a declining population through 2050.
- End-use energy demand continues to decline in both scenarios: -23% (REF) and -27% (CN).
- Electrification of the building and transport sectors displaces fossil fuels.
- Wind and solar electricity generation is expected to increase in both scenarios. Much higher levels of offshore wind contribute to significant additional decarbonisation in CN.
- Japan remains a net energy importer through 2050.
- However, import dependency in its primary energy supply decreases due to decreases in demand and an increase in renewables and nuclear electricity generation.
- From 2018 to 2050, CO_2 emissions decline more than 50% in REF and greater reductions (80%) are possible in CN.
- Energy intensity drives the largest emissions reductions, in addition to emissions intensity and a declining population.

Thank you.

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